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EDITORIAL.

FOR the second time in the brief history of the JOURNAL OF GEOLOGY, we are called upon to record the loss of a member of its editorial staff. And now, as before, it is one in the prime of life, in the midst of a brilliant career, and in the enjoyment of rare prospects, Dr. George M. Dawson. Less than a year ago, he was elevated to the directorship of the Geological Survey of Canada, a position which he had amply earned by a score or more years of markedly successful work on the geology of the Dominion. His "Geology and Resources of the 49th Parallel," prepared when he was yet a very young man, gave him a recognized place in the scientific world. It has been followed by a long list of papers of unusual merit. It is to Dr. Dawson especially that we are indebted for the geology of the northern cordilleras and the great northwestern plains beyond the national boundary. His studies lay along many lines, and the wide range of his abilities peculiarly fitted him for the multitude of questions that were presented in the exploration of his vast and varied field. We hope to present a more adequate notice of his work in a succeeding number. T. C. C.

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IN the very interesting experiments on ice motion, described by Mr. Case on previous pages of this number of the Journal, it may be worthy of note, that the force employed was localized and horizontal. In a glacier, if it be assumed to act as a viscous liquid, the force is distributive and primarily vertical. In so far as there is a horizontal component it is derived from the vertical. It is therefore never in excess of the vertical (momentum and the lag in local adjustment aside). In a perfect liquid it is precisely equal. In a viscous liquid receiving additions above, the horizontal is necessarily less than the vertical force (except locally). A horizontal force greatly in excess of the vertical does not therefore closely imitate the agencies of glacial motion, if it be true that a glacier acts as a viscous liquid.

If a glacier be presumed to move by means of granular changes, the ratio of vertical and horizontal forces may still be essentially the same, for the granular action may be merely a mode of motion under gravity. If, however, the growth of the granules brings into play the forces of crystallization, it is conceivable that the ratio of vertical and horizontal forces may not remain the same. It may be conceived that the amount of crystalline force brought into action along any given line is somewhat correspondent to the number of granules lying in that line, or to the length of the line. If this be true, the axis of the glacier would represent the line of greatest force. Gravity would of course interpose its influence and the combined result would be merely a greater or less departure from the mode of action under gravity alone. Probably no one will doubt that gravity dominates the phenomenon.

The experiments of Mr. Case more nearly reproduce the conditions of this phase of the granulation hypothesis than those of the viscosity hypothesis.

It is obvious that the nature and mode of application of the forces employed are critically important in dealing with a substance on the border line between the solid and liquid states. It is quite possible to manipulate a liquid so that it shall deport itself like a solid, and conversely, to handle a solid so that it shall deport itself like a liquid. A solid may be made to flow, or seem to flow like a liquid, and a liquid may be made to shear or to seem rigid like a solid. In these cases it is the manipulation rather than the nature of the substance that gives expression to the result. A semi-solid is peculiarly sensitive to the mode of manipulation, and in experiments with bodies of this class the interpretation of results is quite as much to be guided by the mode of manipulation as by the nature of the substance manipulated. The experiments of Mr. Case, therefore, only whet our interest to a keener edge. Is it the viscidity of the wax and the mode of thrust that gives the similitude to the phenomena of the Greenland glaciers? T. C. C.

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THE beautiful investigations of Dr. O. Mügge, which have come to hand since the above was put in type, go straight to the heart of one phase of the subject, viz., the method of internal movement of ice crystals when deformed by an external force.[1] Prisms were cut from carefully formed ice in various directions to the principal crystallographic axis, *i. e.*, the optic axis of the crystal, particularly in directions parallel and transverse to it. These were tested by placing their ends on supports and weighting them in the center. In testing the transverse prisms the optic axis was first placed in a vertical position. The prisms sagged and their ends were drawn inward. Optical examination showed that the optic axis remained normal to the bent surface. Subsequent observations on surfaces fractured for the purpose showed striation and other indications that plates of the crystal parallel to the basal plane had *sheared* upon one another.

When similar prisms were placed so that these gliding planes stood on edge, *no appreciable result followed*, even though greater weights and longer times were employed.

When prisms cut parallel to the principal axis were tested, the gliding planes being transverse to the prism, the weight sunk sharply into the upper face of the prism, and a *corresponding protrusion appeared below*. As the process continued, the protrusion below kept closely parallel to the indentation above, both widening somewhat, until a section of the prism had been pushed entirely out. Optical examination showed that the optic axis remained parallel to itself throughout. The block remained transparent and free from fracture. The weight appeared to have simply slipped the plates over their neighbors, carrying the adjacent ones forward with them to some extent by dragging, but not visibly affecting the more remote ones.

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[1] Uber die Plasticität der Eiskrystalle. Separat-Abdruck aus dem Neuen Jahrbuch fur Mineralogie, etc., 1895. Bd. II.

If a prism be made up of square cards and placed on its side and a transverse force be applied, the result will illustrate the apparent method of movement within the ice crystal in this last case. If such a prism be pressed at right angles to the cards, it will illustrate the bending of the first case, and if the cards be placed on edge, they will illustrate the effectual resistance to deformation of the second case. Variations of temperature through 10°, were not found to produce notable differences of result.

Not to mention other significant points, the investigation seemed to warrant the important conclusion that ice crystals yield to deforming forces by the sliding or shearing of the crystalline layers at right angles to the principal axis. No analogy to the motion of a viscous fluid appeared. Dr Mügge had previously found a similar method of deformation in other minerals, including gypsum, stilbite and vivianite. In respect to its mode of internal motion, ice is therefore to be classed with these minerals rather than bodies properly called viscous.

From these trenchant experiments it would appear that there is a suggestive analogy between the shearing movement of the crystalline plates within the ice crystal and the shearing motion of the individualized layers of the Greenland (and presumably other) glaciers. The ulterior question of the source of motion in glaciers is not reached by these investigations, though they offer suggestions of the first importance. They seem, however, to cut at the roots of the viscosity hypothesis by showing that ice-deformation is not even analogous to the internal movement of a viscous body. The word *plasticity*, as a very general term indicating the yielding of solid bodies, may still be applied to ice, but is not the term viscosity already sufficiently burdened with duplicity to entitle it to relief from further service in this much battled field?

T. C. C.

Beginning with the first number of Vol. IV, the Journal will present a series of four articles under the head of "Studies for Students," by Professor Van Hise, on (1) Movements of Rocks Under Deformation; (2) Analysis of Folds; (3) Cleavage and Fissility; (4) Joints and Faults. Dr. Van Hise has recently given these subjects very careful study, and his synopses will undoubtedly possess rare merit. C.